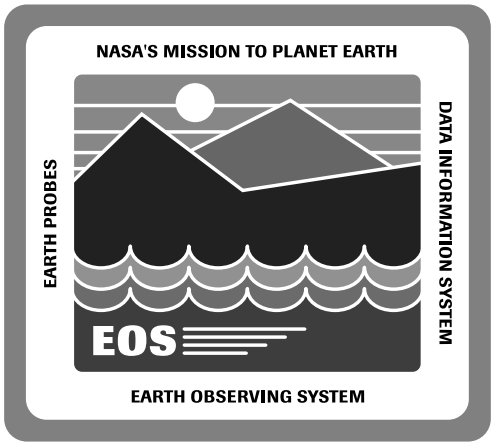


Segment Scenarios

Scott Carter

16 October 1995

FOS CDR Roadmap

FOS CDR Overview
- FOS CDR goals
- Driving requirements

Engineering Activities
- Activities since PDR
- FOS team approach

System Architecture
- Overview
- Features

IST
- Capabilities
- Plans

Hardware Design
- Computers
- Peripherals

Network Design
- EOC LAN
- IST Connectivity

FOS Infrastructure
- Mgt Services
- Comm Services

Subsystem Design
- Detailed design
- FOS functions/tools
- Subsystem design features

RMA
- RMA allocation
- FMEA/CIL

Operations Overview
- EOC facilities
- FOT positions

Operational Scenarios
- End-to-end flow
- Operations perspective
- FOT tool usage

Development
- Release Plan
- Development approach

Testing
- Test approach
- Test organization

Scenario Template Legend


User or External Interface


Real -Time Server (RTS)


User Station (US)


IST workstation (IST)


Data Server (DS)


Infrastructure services


Subsystem identifier

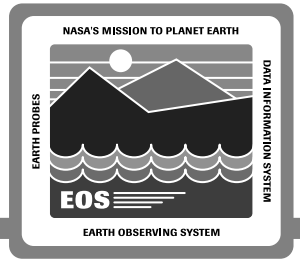

Event flow indicator


Hardware label

Subsystems

FUI - FOS User Interface Subsystem
PAS - Planning and Scheduling Subsystem
DMS - Data Management Subsystem
ANA - Analysis Subsystem
CMS - Command Management Subsystem
TLM - Telemetry Subsystem
RMS - Resource Management Subsystem
RCM - Real Time Contact Management Subsystem
CMD - Command Subsystem

Segment Scenarios



Objectives

- **Parallel scenarios presented by Flight Operations Team**
- **Identify software subsystem processes by hardware location**
- **Primary system scenarios**

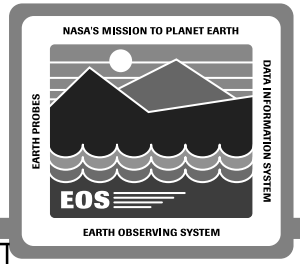
Contents

- **Scenario activities table**
- **Software processes by location**
- **Integrate component building blocks**

Scenario Activities Table

OPS POSITION	System Initialization	Scheduling	Real-Time	Analysis	Load Management	S/C Activity Log	SSR	RTS Failover
OPSCON	X	X	X		X	X	X	X
CAC	X		X		X	X	X	X
SCEVAL			X	X	X	X	X	
IMEVAL			X	X	X	X	X	
Scheduler		X			X		X	
Off-Line Eng.		X	X	X	X	X	X	
System Products	Windows, Logical Strings	Ground Schedule, Ground Script, Reports	Event Messages, Reports, Telemetry, Commands, Alarms, Ground Script, Loads	Tables, Reports, Events	Load Schedules, Load Reports, Load Catalog, Dump Reports, Compare Reports	Dump, Report, Event Messages, Displays	Messages, Command Requests, Reports, SSR Analysis Display	Messages, Logical Strings

FOS Processes by Location



US

PAS Communication Scheduler*
PAS Uplink Scheduler*
PAS SSR Update

PAS ATC Load Generator*
PAS Event Scheduler*
PAS Long Term Plan Ingester*

IST

PAS Plan Releaser*
PAS Timeline*
PAS Activity Recycler*
PAS Data Distributor
PAS ASTER I/F*

PAS Resource Model
PAS Activity Scheduler*
PAS Plan Tool*
PAS BAP Definer*

ANA Request Manager
ANA Request Process

FUI Environment Controller
FUI User Login
FUI Windows**

RMS String Manager
RMS Parameter Server(sys)*

RCM NCC Input*
RCM NCC Output*
RCM EDOS Input*
RCM EDOS Output*

TLM Decom H&S*
TLM Decom HK*
TLM Decom Standby*
TLM Diagnostics*
TLM Parameter Server(string)*

ANA SSR Management
ANA S/C Activity Log*
ANA Expert Advisor
ANA Clock Correlation*
ANA NCC/EDOS Stats*

DS

DMS File Manager
DMS PDB Input*
DMS PDB Edit*
DMS PDB Reporting*
DMS PDB Validation*
DMS OD Generation*
DMS Playback Merge
DMS Event Archiver
DMS Queue Manager
DMS Disk Cleaner
DMS SCDO/External Handler

FUI Analysis Request Handler*

DMS Event Handler
DMS Event Listener
DMS Data Retriever*
DMS Event Retriever*

FUI Standing Order Manager
FUI Command Request Handler

CMS Schedule
CMS S/C Model
CMS Load Catalog
CMS Command Model
CMS Ground Schedule

TLM State Check*
DMS Archiver*
FUI Ground Script Controller*

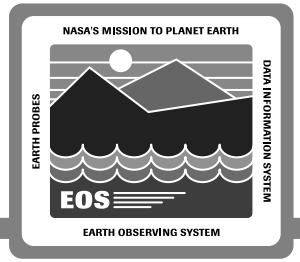
RMS Resource Monitor

RTS

CMD Fop Command*
CMD Format Command*
CMD Transmit Command*

* Transient Processes
** approx 30 specific processes

System Startup Scenario



Pre-condition

- **Software installed**
- **Database installed**

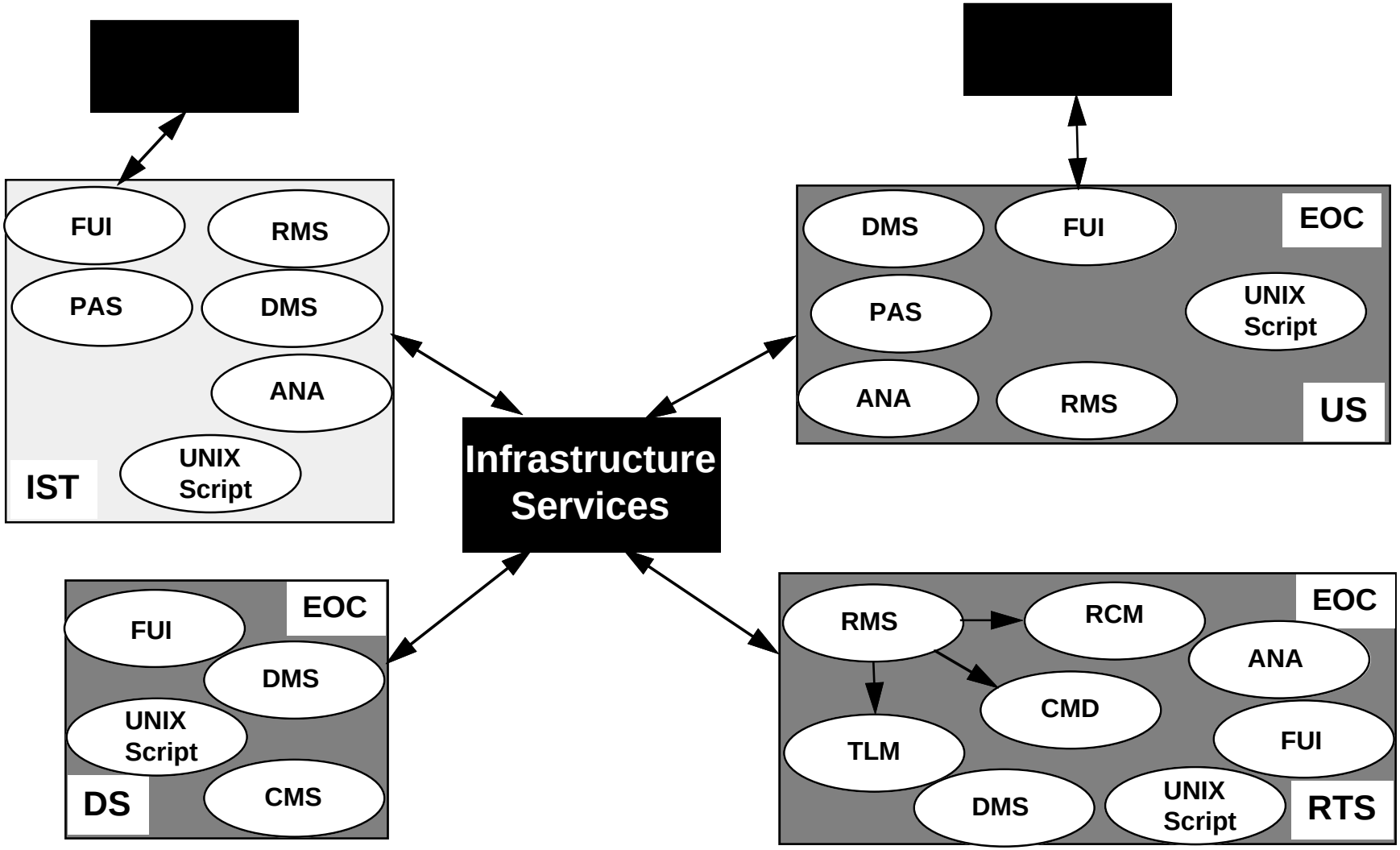
Initiate Infrastructure Services

- **Power-up communications equipment**
- **Power-up UNIX machines**
- **Establish default LAN configuration**
- **Establish external interface communication**
- **Start Sybase server**

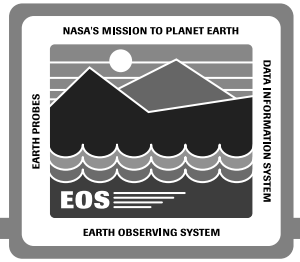
Boot Services

- **Execute UNIX scripts**
- **Establish default logical strings (RMS)**
- **Provide user login window where applicable**

System Startup Scenario (cont.)



Scheduling Scenario



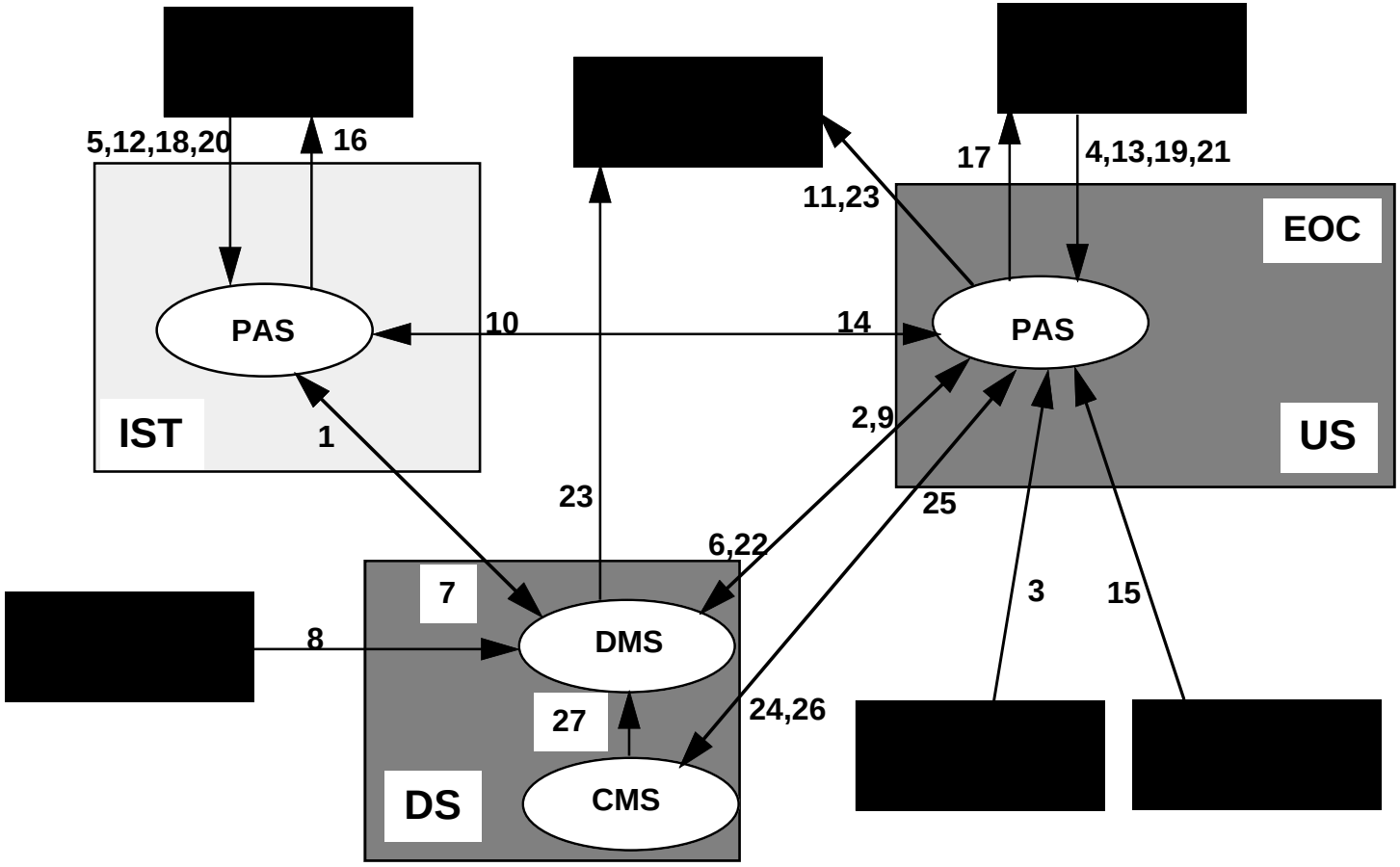
Pre-scheduling

- **Obtain support data from DMS and SMC (1,2,3)**
- **Update activity definitions (4,5,6,7)**
  - **DBA loads CCB approved activity definitions**
- **Receive, validate and transfer orbit products (8,9,10,11)**

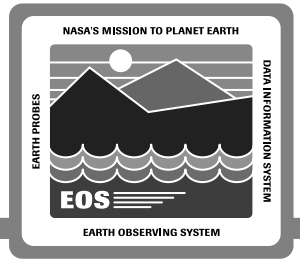
Scheduling

- **Generate and schedule BAP requests (12,13,14)**
- **Schedule activities - schedule TDRSS, activity constraint check, timeline display (12,13,14,15,16,17)**
- **Schedule deviations (18,19) - (i.e., one day schedule, late changes)**
- **Request generation of the detailed activity schedule (DAS), ATC Load and ground schedule (20,21)**
- **Archive DAS (22,23)**
- **Generate ATC load and schedule for uplink (24,25)**
- **Generate and store ground schedule (26,27)**

Scheduling Scenario (cont.)



Real-Time Scenarios



Pre-Contact

- **Covers events beginning 20 minutes prior to scheduled AOS**
- **Activities driven by the ground script**
- **Terminates with AOS**

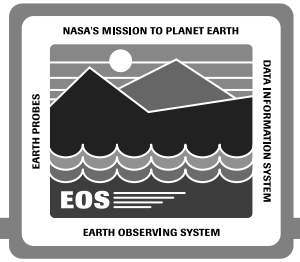
Contact

- **Begins with scheduled AOS**
- **Ends with LOS**

Post-Contact

- **Begins with LOS**
- **Covers events after LOS that directly relate to the contact**

Pre-Contact Scenario



Pre-Conditions:

- **Establish a logical string**
- **Connect to a logical string**

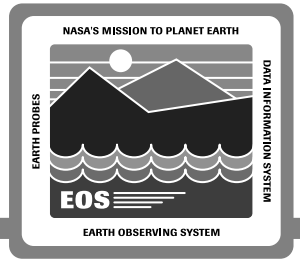
Between 10 and 20 minutes prior to contact

- **Hardware check (1)**
- **Software configuration check (2,3)**

Between 5 and 10 minutes prior to contact

- **Issue command authorization request (4)**
  - **Ensures a single point of command (4)**
  - **Accepted from a select group of users**
  - **RMS verifies authorization request (4,5)**
  - **RMS informs CMD of valid authorization (6)**

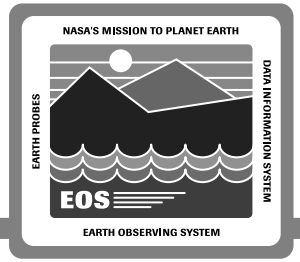
Pre-Contact Scenario (cont.)



Between 5 and 10 minutes prior to contact (cont.)

- **Issue ground control request**
  - **Ensures a single point of ground control (4)**
  - **Accepted from a select group of users**
  - **RMS verifies ground control request (4,5)**
- **Issue directives to customize the string connection**
  - **CMD: Set prerequisite checking and verification flags (4,5,6)**
    Set CMD configuration to mirror uplink path(6)
  - **TLM: Set desired limit & delta values (4,5,7)**
    Set limit violation message mode (4,5,7)
- **Conduct ground script review - FOT**
  - **Ground script produced by CMS and passed to FUI (8)**
  - **FUI displays ground script for review (9,3)**

Pre-Contact Scenario (cont.)



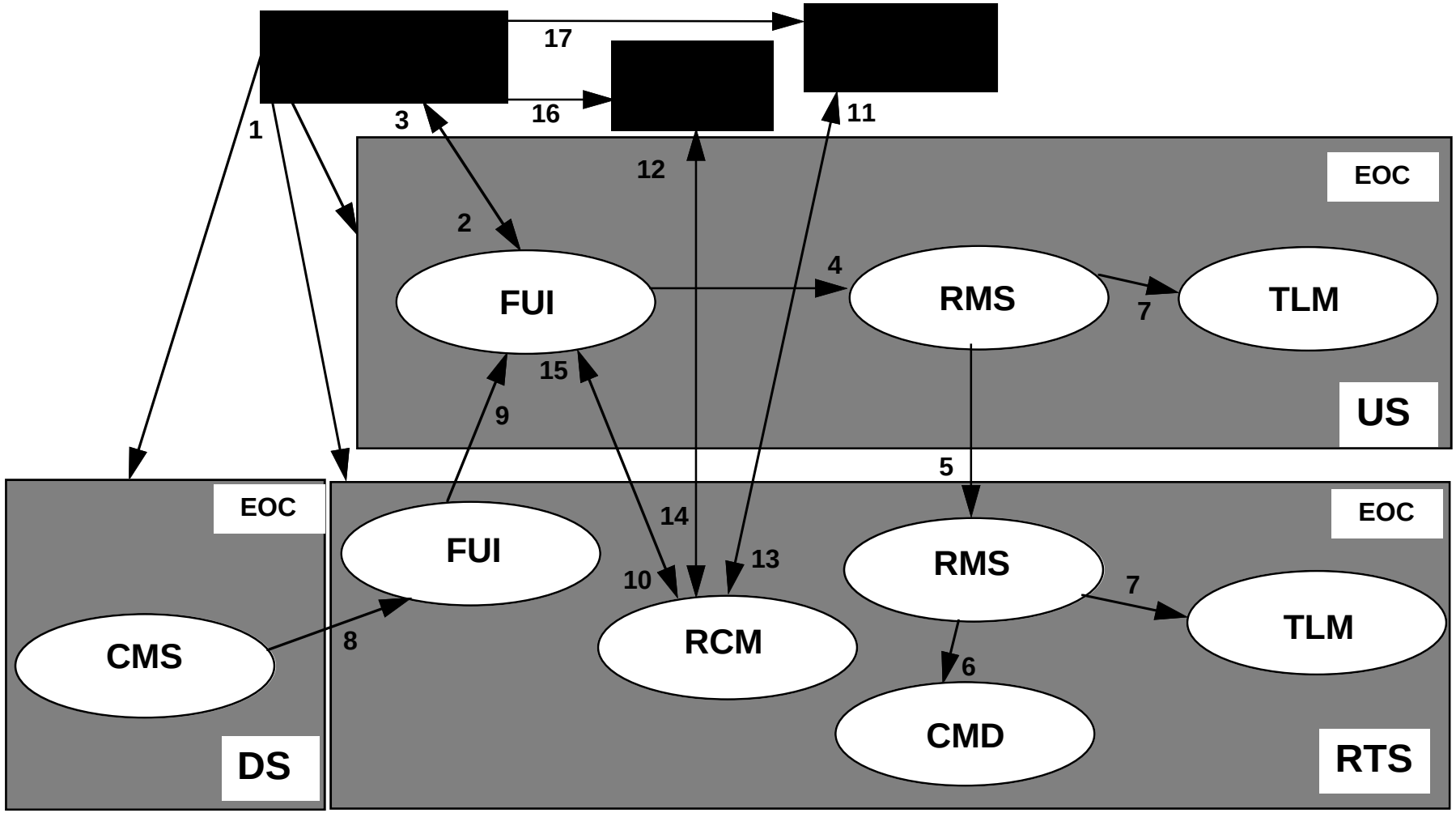
Between 5 and 10 minutes prior to contact (cont.)

- **Issue communications test messages**
  - **FOT issues directives through FUI (2,4)**
  - **Send & receive NCC and EDOS test messages via RCM (10,11,12,13,14,15)**
  - **Verifies initial NCC link via communication test message (14)**
- **Send performance data request to NCC (10,12)**
  - **Enable user performance data message**

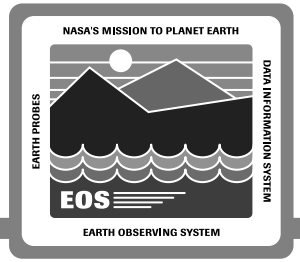
Less than 5 minutes prior to contact

- **FOT issues pre-contact briefing (16,17)**

Pre-Contact Scenario (cont.)



Real-Time Contact Scenario



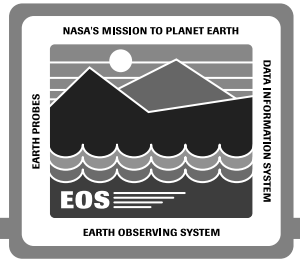
Command Activities

- **FUI issues manual & ground script directives to CMD (1,2,3,4,5)**
- **≠CMD queries & receives telemetry values for prerequisite checking(6,7)**
- **CMD provides FUI prerequisite status of commands (8)**
- **Forward commands and load data to EDOS for transmission (9)**

Telemetry Activities

- **EDOS returns telemetry data to TLM (10,11)**
- **Archive raw telemetry through DMS(12)**
- **Verify command execution**
- **Determine load success/fail status using CRC (7)**
- **≠CMS notified of uplink status - maintains load catalog and ground image (13,14,3)**

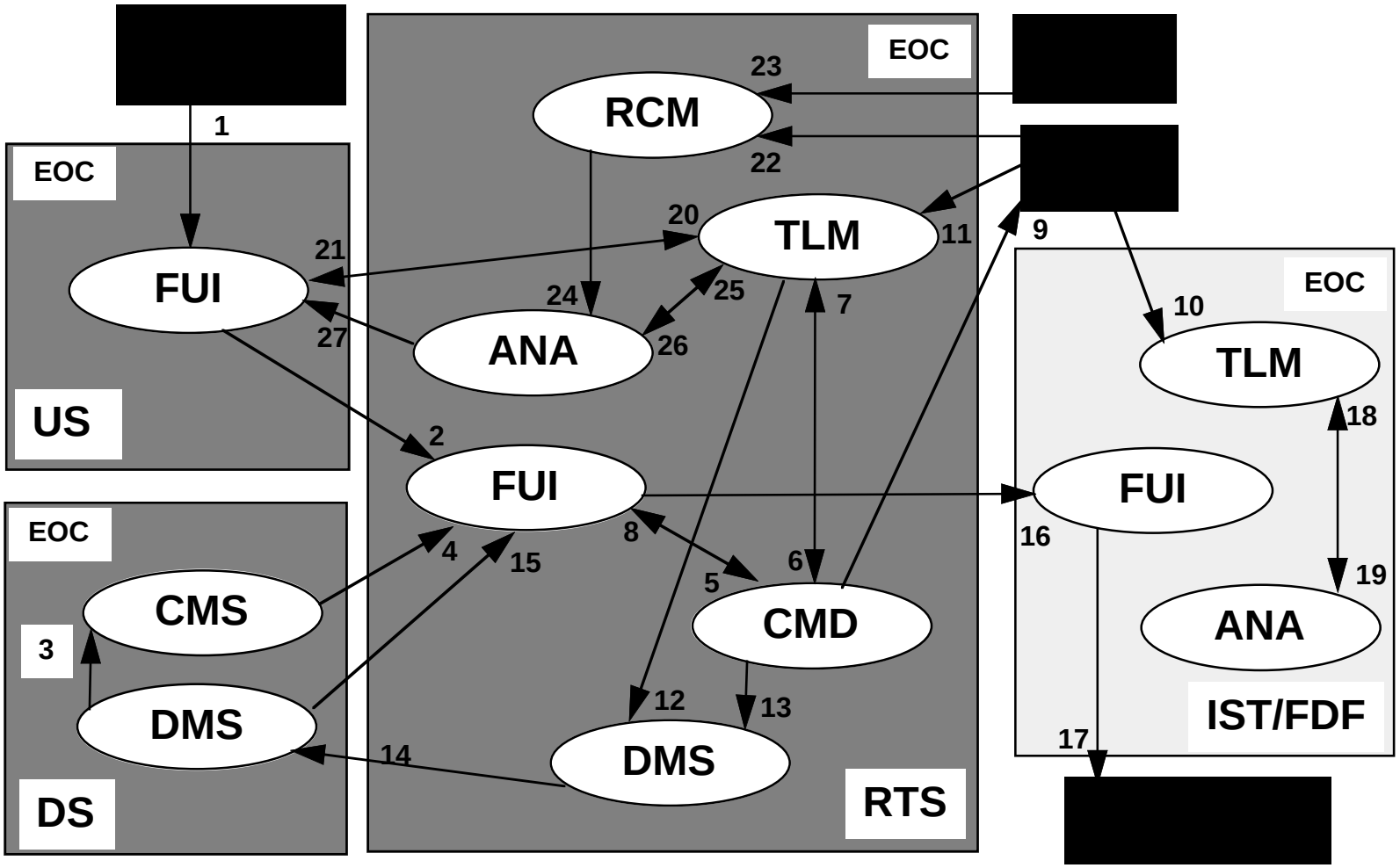
Real-Time Contact Scenario (cont.)



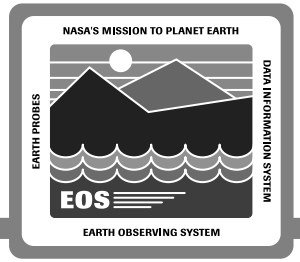
Telemetry Activities (cont.)

- **Each IST informed of instrument command status (13,14,15,16,17)**
- **TLM provides requested attitude data to FDF (18,19)**
- **TLM provides S/C telemetry parameters to FUI for display (20,21)**
- **RCM provides ground parameters to ANA (22,23,24)**
- **TLM provides S/C telemetry parameters to ANA (25,26)**
- **ANA provides analysis report to FUI (27)**

Real-Time Contact Scenario (cont.)



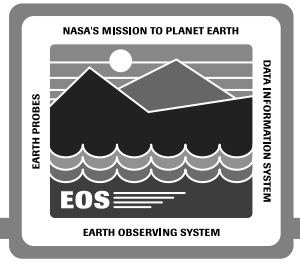
Post-Contact Scenario



First 5 minutes following LOS

- **Performance data (RCTDs and TTM) sent from NCC via RMS (1)**
  - **Archived via DMS (2)**
  - **Provided to ANA (3)**
  - **Available to user via FUI (4, 5)**
- **ANA performs clock correlation and produces a report**
  - **Report archived via DMS (6)**
  - **Report is available for display via FUI (7, 5)**

Post-Contact Scenario (cont.)



Between 5 and 20 minutes after contact

- **TSS forwarded from EDOS to DMS (8)**
- **Back-orbit data sent from EDOS to DMS (8)**
  - **DMS merges back-orbit data with Real-Time data (9)**
  - **DMS issues analysis request to perform statistics on the back-orbit data (10)**

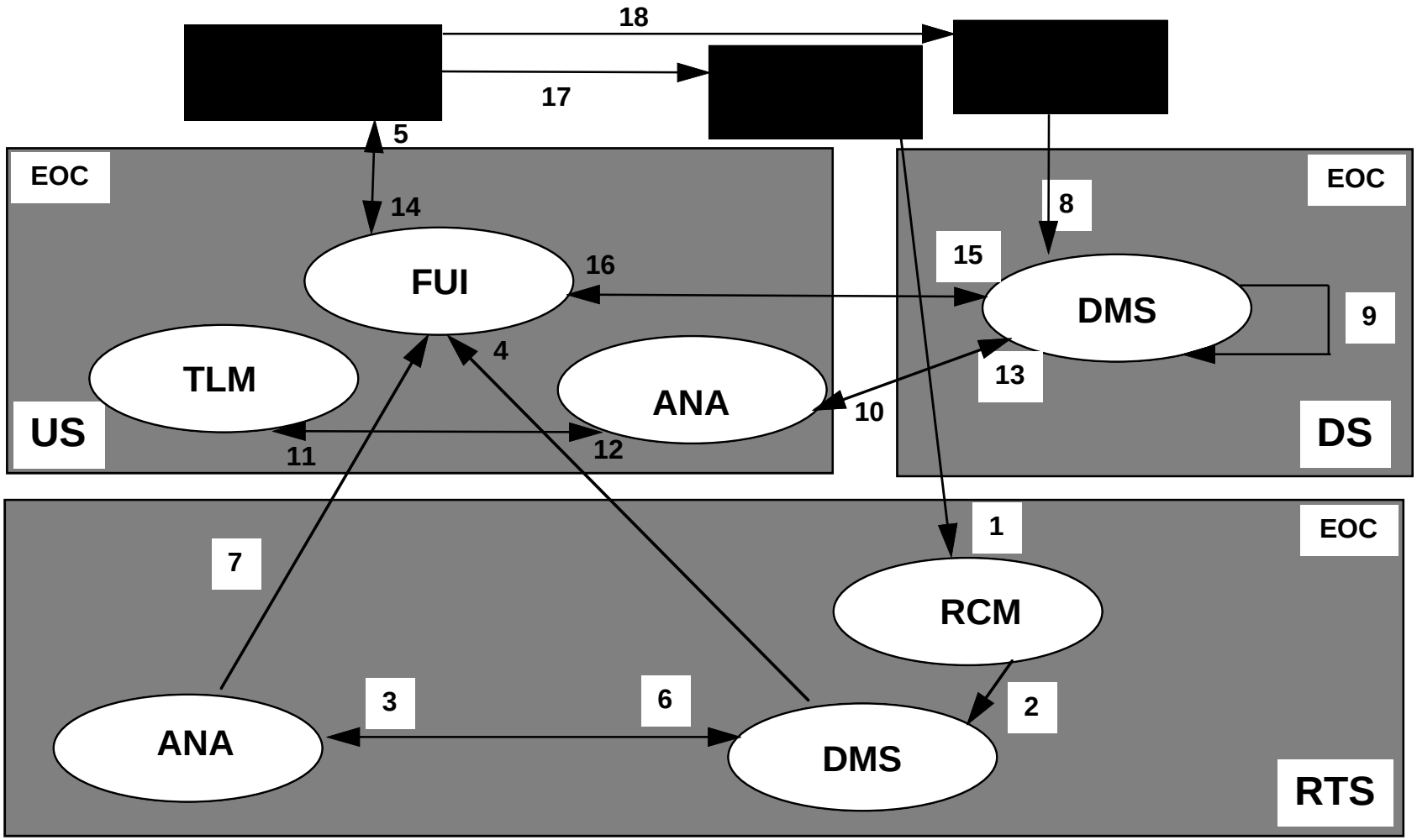
    Back-orbit data decommutated by TLM (11,12)

    Statistics report provided to DMS (13)

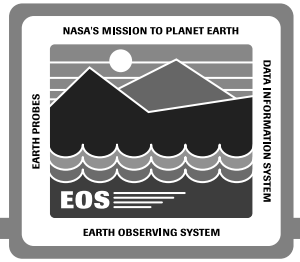
20 minutes after contact

- **FOT produces a limits report via FUI (14,15)**
  - **DMS provides limit violations report to FOT & IOT via FUI (5,16)**
- **FOT issues a post-contact debriefing (17,18)**

Post-Contact Scenario (cont.)



Analysis Request Scenario



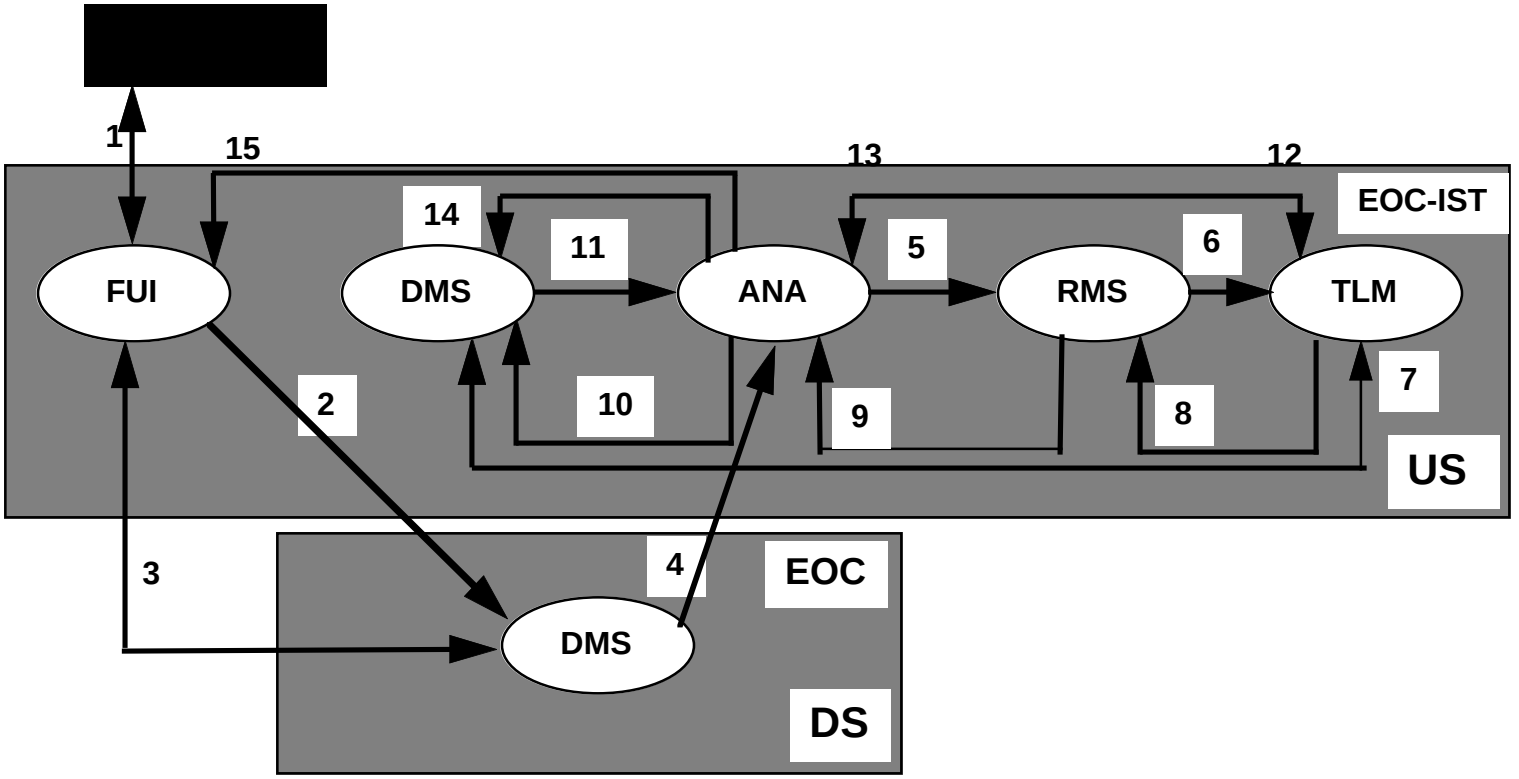
Request Processing

- **Analysis request issued through FUI and queued by DMS (1,2)**
- **Analysis request status provided to FUI(1,3)**
- **DMS determines user station with optimal processing resources and notifies ANA of pending processing request (4)**

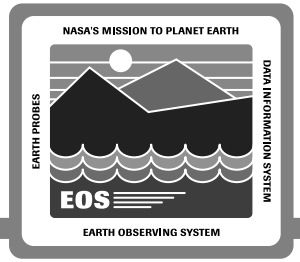
Support Processing

- **ANA requests processing services from RMS (5)**
- **RMS instanciates TLM process(6)**
- **TLM receives requested DB ID from DMS(7)**
- **TLM notifies ANA of "ready state" through RMS (8,9)**
- **ANA requests data from DMS(10-11)**
- **ANA sends data packets and parameter list to TLM(12)**
- **ANA generates datasets for storage and display(13,14,15)**
- **ANA notifies RMS of telemetry processing completion (5)**
- **RMS deactivates TLM process(6)**

Analysis Request Scenario (cont.)



Load Processing Scenario



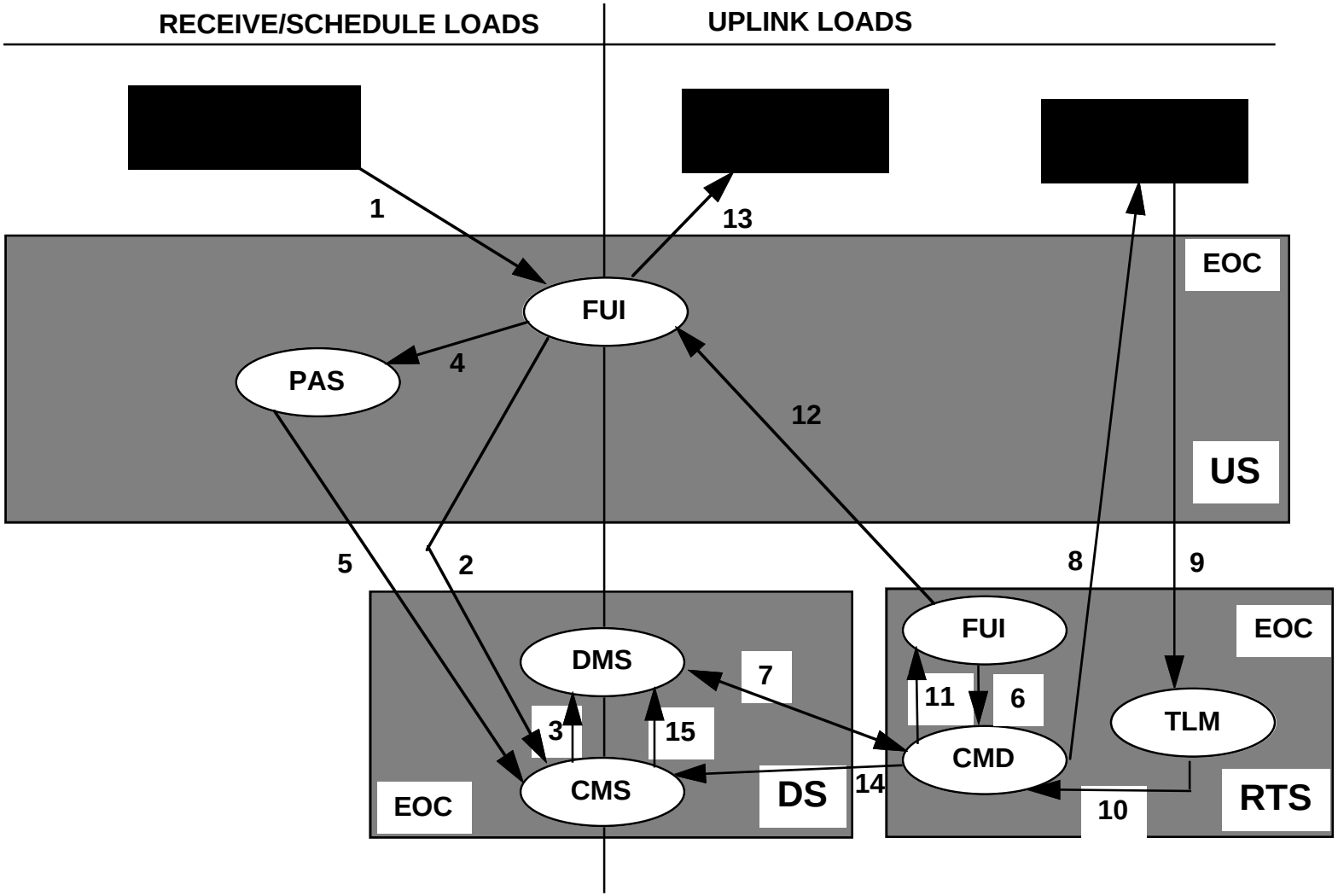
Receive/Schedule Loads

- **Load types - Microprocessor, RTCS, Table, Flight S/W**
- **Load sources - SCF,SDVF,User(1)**
- **FUI filters and forwards load contents to CMS for validation and load generation (2)**
- **DMS stores valid loads and CMS updates the load catalog (3)**
- **PAS schedules load uplink and forwards DAS to CMS (4,5)**

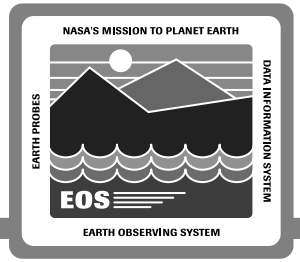
Uplink Loads

- **FUI sends load uplink execution request to CMD (6)**
- **CMD retrieves load/load catalog information from DMS and uplinks load through EDOS (7,8)**
- **TLM receives and forwards command related telemetry to CMD (9,10)**
- **FUI displays load uplink status to the User (11,12,13)**
- **CMD performs load verification, and notifies CMS of successful uplink(14)**
- **CMS updates load catalog, buffer model and ground image(15)**

Load Processing Scenario (cont.)



Dump Processing Scenario



Requesting Dumps

- **User issues dump request for CMD through FUI(1-2)**
- **CMD sends dump command to EDOS, and notifies TLM and DMS(3,4,5)**

Receiving Dumps

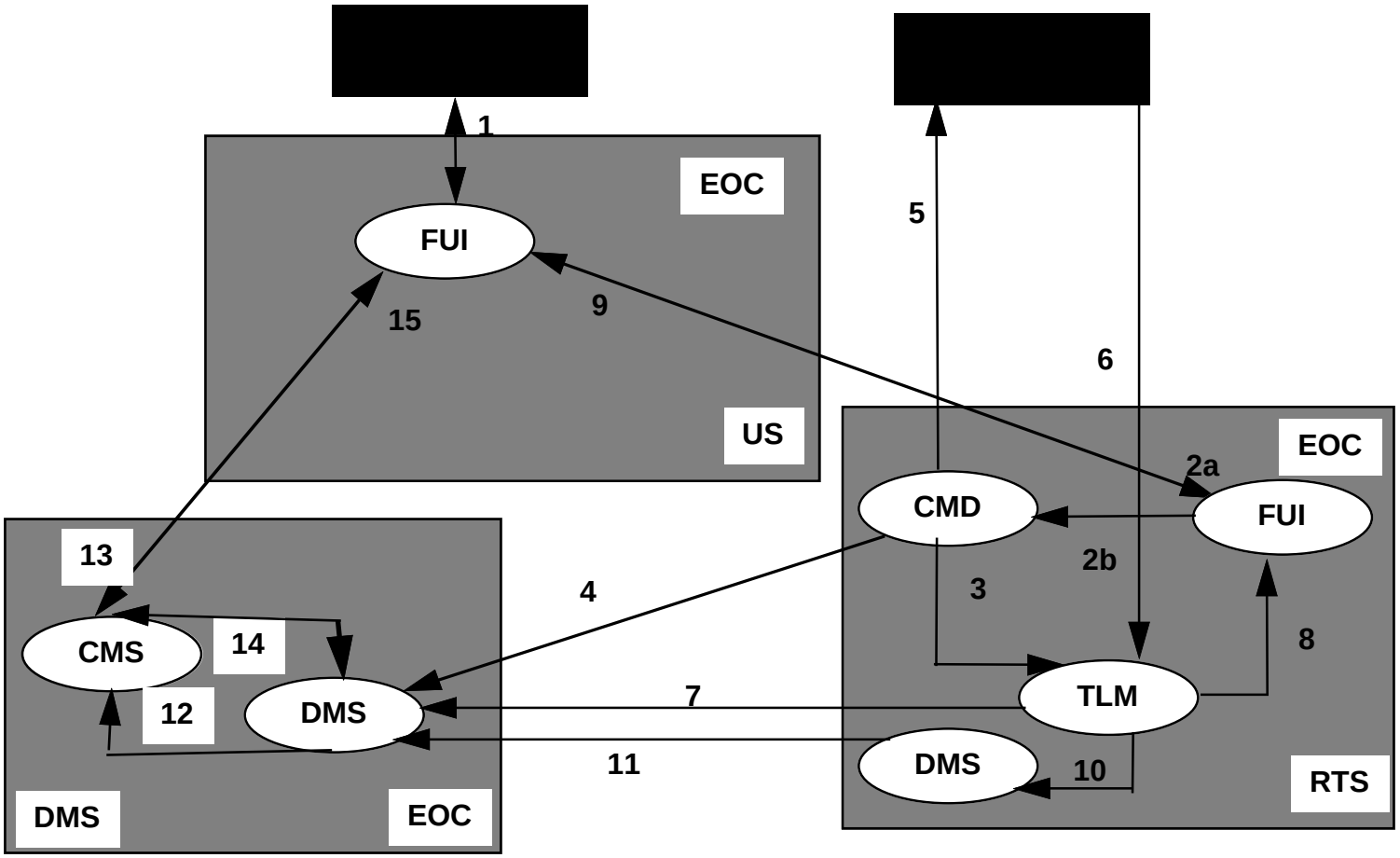
- **TLM receives dump data from EDOS(6), stores dump data in DMS(7), and notifies User of dump completion(8,9)**
- **TLM notifies CMS of dump completion through DMS (10,11,12)**

Processing Dump

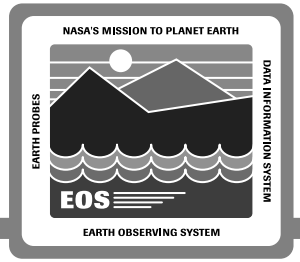
- **CMS retrieves dump data from DMS (14) and automatically generates dump image**
- **User requests dump image compare by CMS(1,13)**
- **Dump image/image compare is displayed by FUI(15) and/or stored in DMS(14).**

Note: ISTs can retrieve microprocessor dumps via KFTP from DMS.

Dump Processing Scenario (cont.)



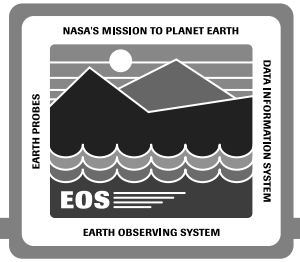
Spacecraft Activity Log Scenario



Real-Time Processing of the Spacecraft Activity Log

- **ANA receives activity log data as decommutated telemetry parameters (1,2)**
- **ANA builds activity log messages from telemetry data (3)**
- **ANA archives activity log messages through DMS (4)**
- **FUI displays activity log related critical event messages (5,6)**

Spacecraft Activity Log Scenario (cont.)



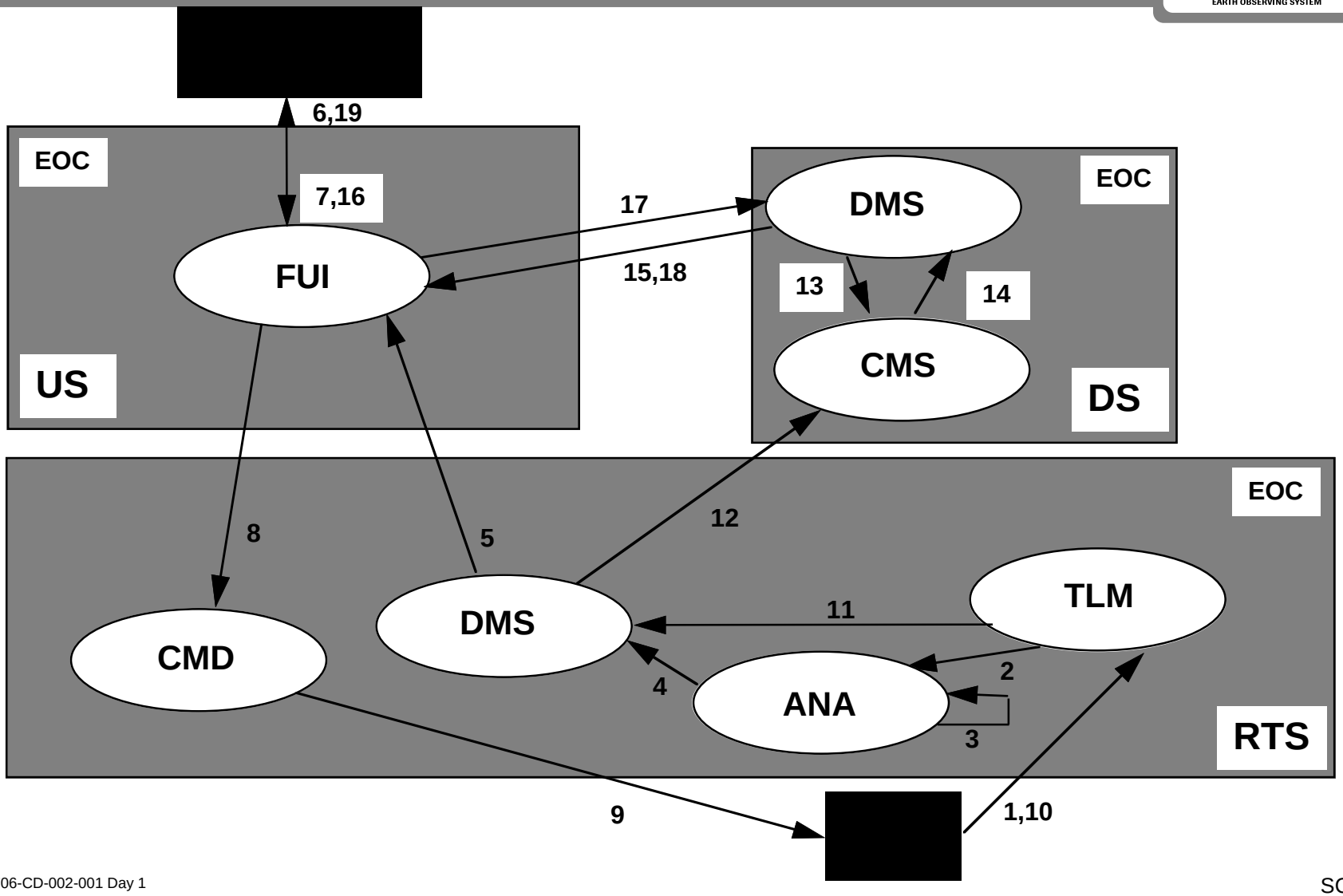
Spacecraft Activity Log Dump

- **Dump command issued to CMD via FUI (7,8,9)**
- **Dump data received by TLM (10) and archived to DMS (11)**
  - **Activity log messages merged in DMS continuous file**
  - **CMS notified of dump completion through DMS (12)**
- **CMS processes dump data**
  - **CMS accesses archived dump data (13)**
  - **CMS formats activity log messages**
  - **CMS archives formatted messages (14)**
  - **Summary event message issued - includes number of critical activities (15)**

Spacecraft Activity Log Report

- **User requests activity report from DMS via FUI (16,17)**
- **Completed report provided to FUI; available to user (18,19)**

Spacecraft Activity Log Scenario (cont.)

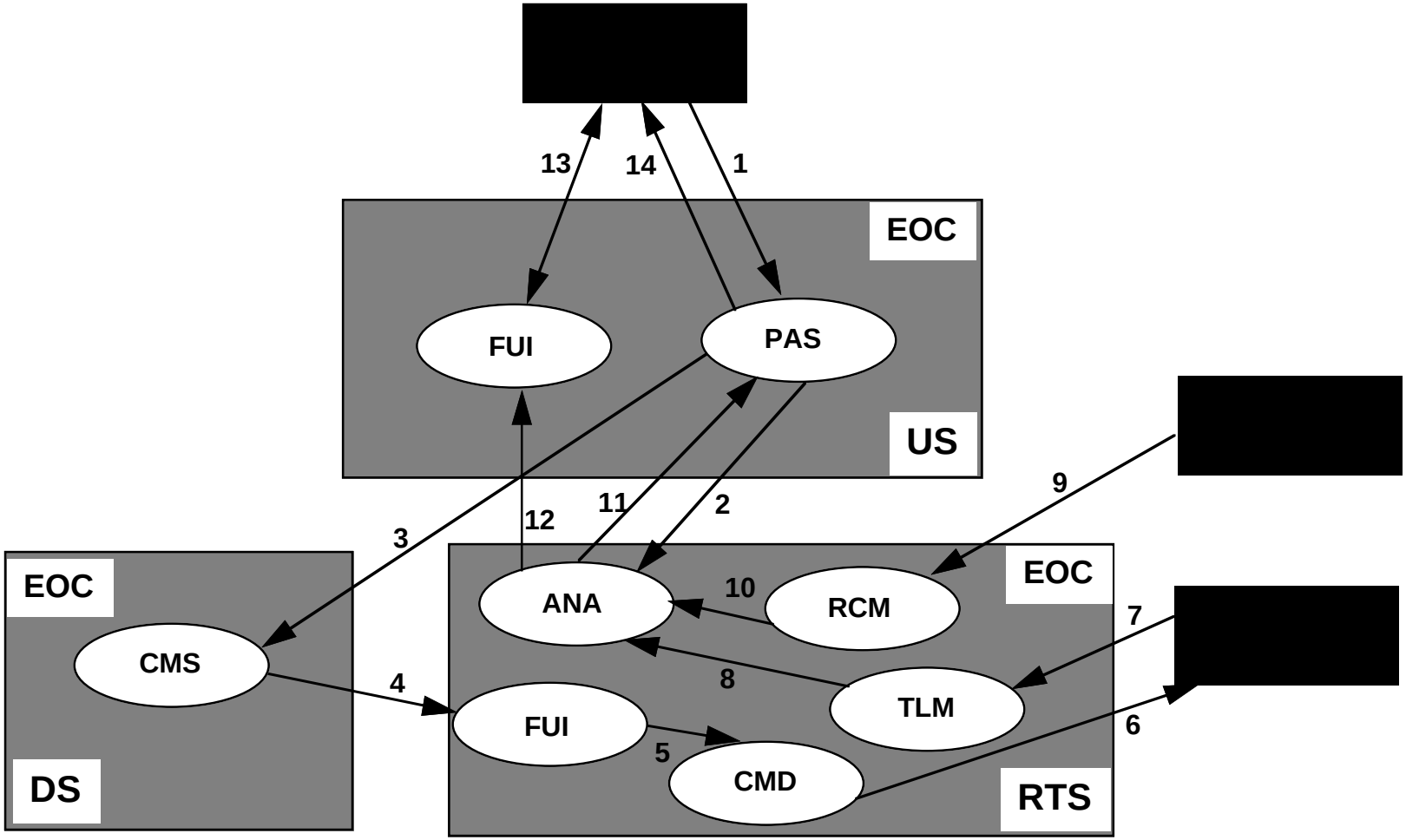


Solid State Recorder Scenario - Nominal

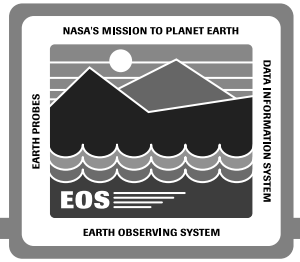
SSR processing phases

- **Scheduling phase**
  - **Schedule SSR playback(1)**
  - **Provide SSR predicts(2)**
- **Real-Time phase**
  - **Initiate SSR playback(3,4,5,6)**
  - **Receive SSR playback status(7,8,9,10)**
  - **Provide status (11,12,13)**
- **Analysis phase**
  - **Send actual playback counters(11,12,13)**
  - **Update SSR model timeline(14)**

Solid State Recorder Scenario - Nominal (cont.)



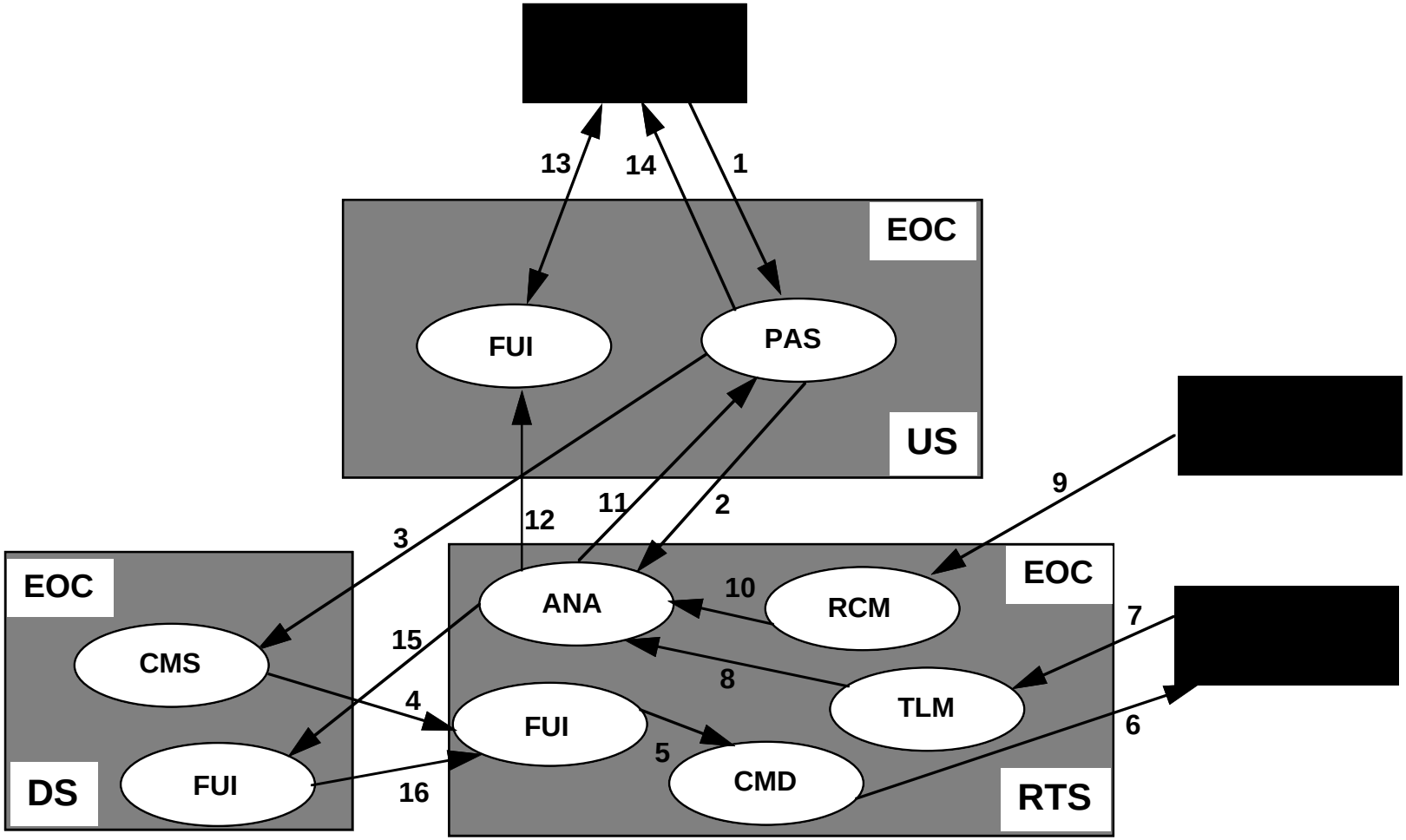
Solid State Recorder Scenario - Anomalous



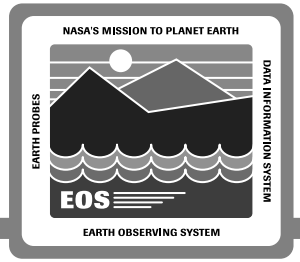
SSR dump recommendations from ANA

- **Generation of a command request to replay SSR data before current contact ends(15,16)**
- **Generation of command request(s) to replay SSR data during the next contact(s)(15,16)**
- **Notification of the need for additional contact time - based on PAS predicts(11,12)**

Solid State Recorder Scenario - Anomalous (cont.)



FDF Interface Scenario



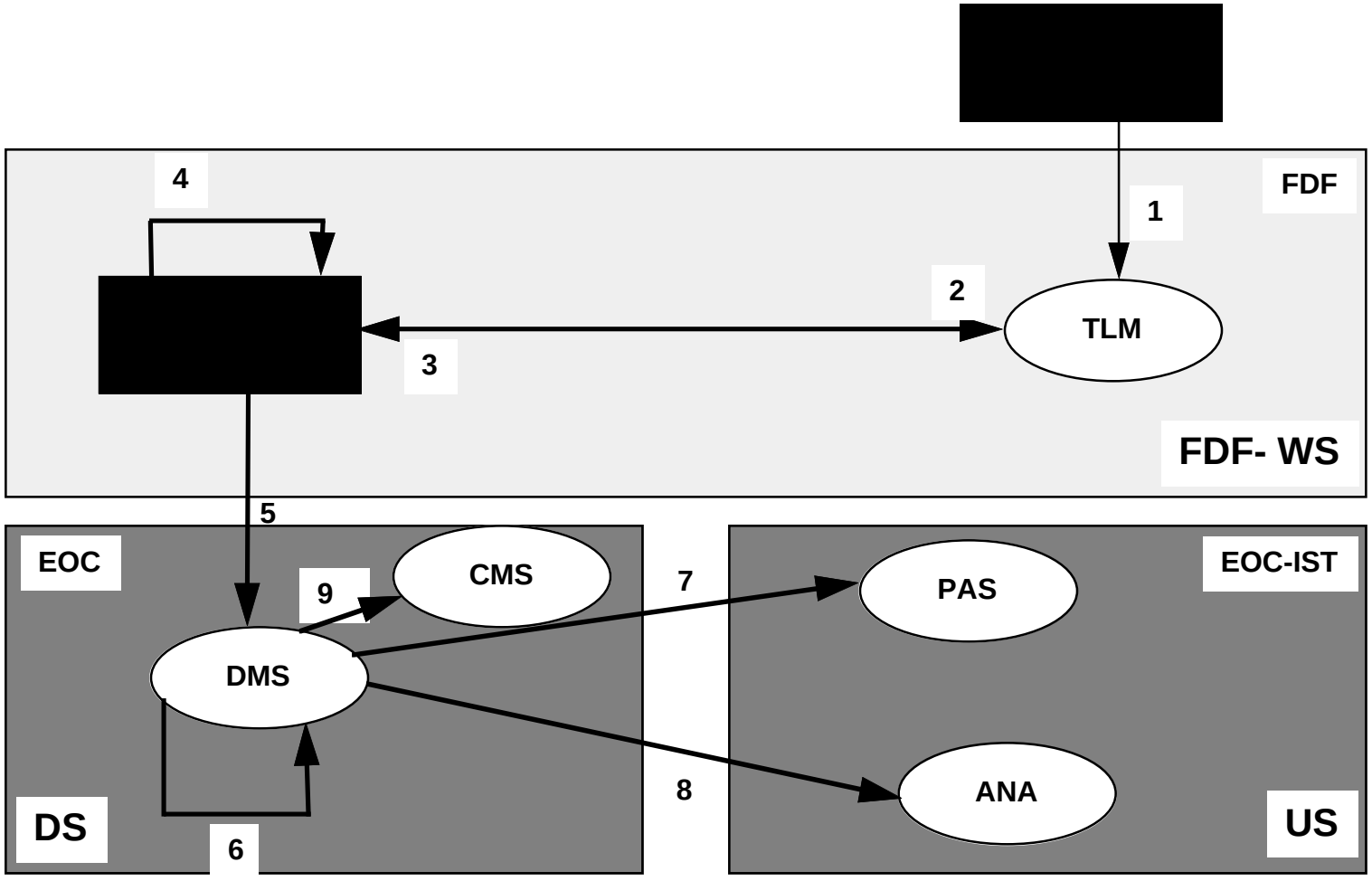
Real-Time Attitude Telemetry Processing

- **EDOS multicasts telemetry to an FDF work station(1)**
- **FDF requests telemetry parameters(2)**
- **RTADs display viewed through FDF S/W**
- **TLM decommutates TONS/attitude telemetry and transfers to FDF software through parameter server(3)**

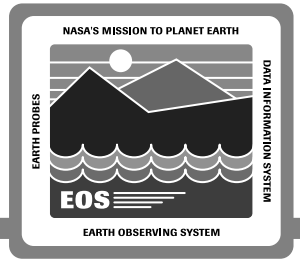
FDF Product Generation

- **FDF generates “Products” and stores them in a DMS directory (4,5)**
- **DMS retrieves and validates FDF products (6)**
- **DMS sends product availability notification to applicable subsystems (7,8,9)**

FDF Interface Scenario (cont.)



RTS Hardware Failover



Design Goal: Failover within 30 sec. of receipt of a failover request

Design Feature: Recovery initiated from a single command

Failure Detection:

- **MSS detects failure and sends warning to DMS (1)**
- **DMS forwards message to RMS (2,3)**
- **RMS issues failure alarm message to User through DMS (4,5,6)**

Recovery:

- **Ground Controller requests failover by RMS (7,8)**
- **User station RMS recognizes RTS-a h/w failure (9)**
- **User station RMS deactivates failed logical string, activates back-up logical string on RTS-bu (10,11,12,13,14)**
- **RMS informs Ground Controller of failover completion (15,16)**

RTS Hardware Failover (cont.)